Ring resonator add/drop filter based on a Photonic Crystal

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Common designs of ring-resonator add-drop filters use ridge waveguides, but the use of photonic crystals can lead to smaller devices due to their smaller bend loss. Such devices have been typically designed using micro-cavities with the proper characteristics [1]. Even though the possibility to realize cavities with whispering-gallery modes in photonic crystals is known and has been applied to the design of lasers, the use of this kind of cavities for add/drop filtering has not been explored. In this work, by using finite-differences time-domain calculations, it is shown that the realization of add/drop filters using ring-resonators is possible. When using a micro-cavity, it is necessary to couple to both modes because the functionality is obtained due to the superposition of the fields from both modes while in a whispering-gallery design, It Is desired to couple to just one of the modes, the one traveling In the proper direction. The required design considerations and the subsequent optimization of our device will be presented. Obviously, apart from add/drop filters, an improved ring resonator can also be useful in lasers.

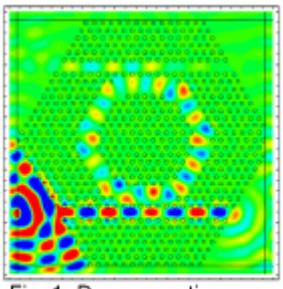

Fig. 1. Drop operation. ε=11.56, Ω=0.3715, Q=430

[1] S. Fan, P. R. Villeneuve, J. D. Joannopoulos, and H. A. Haus, Opt. Express 3, 4-11 (1998).